Advancing a Cleaner, Smarter Energy System

EnerNex

A CESI Company

EnerNex: Your Partner for Tackling Energy Transition Challenges

EnerNex, a CESI company, is part of a world-leading energy technology and innovation consulting group operating on five continents. Leveraging expertise across the CESI Group, EnerNex provides innovation and deep sector competence to help with the planning, implementation, and operation of power assets and electric infrastructures needed to meet clients' ever-increasing energy transition challenges.

Our team of experienced power engineers, control systems professionals, program managers, and regulatory and business experts have the know-how to develop viable, timely energy solutions that bring measurable benefits to our clients.

Our clients include:

- Utilities and Large Energy Consumers
- Industry Solution Providers and OEMs
- Energy Project Developers
- Government Agencies and Research Organizations

We invite you to learn more about how we can help advance technologies and improve the operation and reliability of the electric power system through the 21st century and beyond.

Core Services

- Electric Energy System Engineering & Analysis
- Renewable and Distributed Energy Integration & Interconnection
- Grid Technology Consulting
- Grid Modernization
- Electric Industry Evolution

Additional Services through our CESI Partners

Testing & Certification

- High Voltage & High Power Testing Laboratories
- Certification
- Owner's Engineering for HVDC/HVAC Infrastructures

Structural & Environmental Engineering

- Structure & Civil Engineering
- Environmental Monitoring Studies
- Environmental & Sustainability Consulting

Due to our wide range of knowledge and expertise, we're experts at solving clients' electric power industry challenges.

Electric Energy System Engineering & Analysis

A deep understanding of power system design, operation, and control is the foundation of our service offerings. We have the expertise and experience for analyzing power system phenomena ranging from high frequency transients to dynamics across the electric power system infrastructure including generation, transmission, distribution, and end use. Coupled with knowledge of new technologies for transforming how modern power system works both now and in the future, EnerNex is positioned to help its clients address almost any analytical need.

Examples of our analytical studies include:

- Transient and harmonic analysis of electric infrastructure from transmission through distribution and into end user premises (EMTP-RV, PSCAD, MatLab)
- Steady state analysis using both conventional (e.g. PSS/E, PSLF, CYME) and emerging tools, such as OpenDSS Field monitoring and measurements for supporting design or diagnosis equipment issues and failures
- Power quality troubleshooting

Project example

NYISO: *Conducted controlled system separation study for bulk power systems to better characterize and maintain stability in individual electric islands.*

Power Systems Engineering

Our engagements typically encompass a wide range of studies including Power Flow Analysis, Short Circuit Study, Harmonic and Transient analysis, Temporary Over Voltage (TOV) Study, Control Interaction Study, Sub-Synchronous Resonance (SSR) Studies, and Insulation Coordination Studies. In order to perform these studies, various power system simulation software packages such as CAPE, ASPEN Oneliner, EMTP-RV, PSCAD, GE PSLF and Siemens PTI PSS/e are utilized in order to fulfill the study objectives and to meet the client requirements.

EnerNex developed, in close collaboration with turbine vendors, detailed vendor-specific transient models of most wind turbine technologies deployed in North America. We have developed transient models in EMPT-RV and PSCAD that act as a basis for further development of dynamic models for simulation platforms such as PSLF and PSS/E.

The following is a listing of power system studies that EnerNex can produce:

- Co-Simulation Studies
- DER Impact Studies
- Power Electronics Studies
- Distribution Reliability Studies
- Transmission Planning Studies
- Generic Model Mapping
- Interconnection of Wind and PV Power Plants
- Microgrid Studies
- Power Quality Measurements
- Power Quality Studies
- Stability Studies
- Transient Studies
- Worker Safety Studies

Additional Power Systems Studies

Co-Simulation Studies

EnerNex can conduct co-simulation studies, which are studies that span across multiple domains (e.g., power systems simulations combined with economic analysis) and comprise the following investigations:

- Marginal Distribution and Transmission Capacity Cost Analysis
- Evaluation of Energy Management Services
- Transactive Energy Analysis
- Energy Storage Multiple Use Energy Storage Analysis

DER Impact Studies

EnerNex can perform impact studies that evaluate the cost and benefits of DER on customer's system.

Distribution Reliability Studies

EnerNex can perform reliability studies that are designed to quantify and reduce customer service interruptions on distribution systems.

Evaluation of New Technologies

EnerNex can provide support for the evaluation of new technologies including optimization functions, distribution state estimator, and smart devices.

Microgrid Studies

EnerNex can conduct microgrid studies to assess distribution design planning and protection requirements for the integration and safe, reliable, and cost-effective operation of microgrids within utility systems.

Power Electronics Studies

EnerNex can conduct studies comprising the development of transient models of inverter-based generators such as PV generators and Type 3 and 4 wind turbine generators.

Power Quality Measurement

Analyses consist of examinations of the acquired data, comparison of all conditions to the guidelines, recommendations and limits established in various power quality standards, and potential mitigation recommendations.

Power Quality Studies

- Harmonic Analysis
- Voltage Sags / Swells Analysis
- Flicker Analysis

Stability Studies

EnerNex can perform stability studies comprised of the following investigations:

- Transient / Voltage / Frequency Stability
- Determination of Stability Limits
- Determination of Critical Contingencies
- Control Interaction of Inverter-Based Generation
- Fault Induced Voltage Recovery (FIDVR) Evaluation
- Subsynchronous Resonance Evaluation
- Geomagnetically Induced Current Evaluation

Transient Studies

Transient studies require Electromagnetic Transient (EMT) type programs and comprises of switching studies and lightning studies.

Renewable and Distributed Energy Integration & Interconnection

The explosion of renewable energy over the past two decades has transformed the way the electric power system is planned, designed, and operated. The analytical skills at our foundation have been applied to these new analytical challenges since the founding of the company in 2003. To date, EnerNex has completed studies for approximately 14,800 MW of wind turbine plant capacity, and 1500 MW solar photovoltaic generator interconnection studies.

Our clients cover the entire spectrum in the renewable energy space, from OEMs of wind turbines, inverters, renewable project developers and operators, transmission service providers, to large Balancing Authority Area operators and energy market administrators. Our engagements have included:

- Wind turbine and inverter model development for OEMs
- Analytical studies in support of the balance of plant design for bulk renewable project developers
- Model development and interconnection studies for bulk renewable plants
- Analysis of power system operation and control with significant penetration of renewable energy
- Evaluation of mechanisms for accommodating large renewable penetrations through advanced operational procedures or new technologies, such as storage
- Detailed assessment of distributed PV and other DER on distribution circuit operation and planning

Project example

EWITS: *Led the Eastern Wind Integration and Transmission Study to help the organization understand the operating impacts due to the variability and uncertainty of large penetrations of wind power.*

Grid Technology Consulting

The rapid evolution of advanced control and communication technologies that are being applied to the electric grid has presented a challenge both to utilities and the organizations who serve them. Similarly, new industry entrants are unprepared to deal with the unique environment of utility technology deployment (e.g., harsh physical environment, life safety critical systems, very high degrees of reliability, inaccessibility of devices, and unique cyber security requirements).

EnerNex offers vendors, utilities and regulatory bodies a place to evaluate and understand technology readiness for smart grid in the areas of:

- Cybersecurity
- IEC 61850
- Utility Procurement Assistance
- Vendor Due Diligence
- Pre-certification Testing
- Communications Cyber Assurance

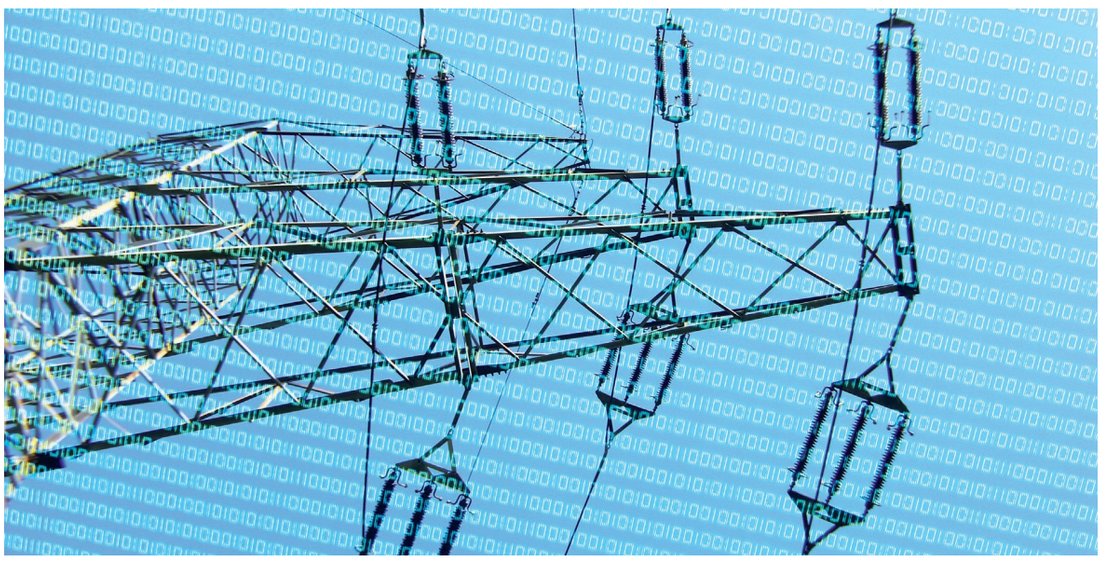
Project example

A Southwestern-area transmission and distribution utility: *Supporting its security architecture and NERC CIP compliance efforts to help protect the organization from potential threats.*

CYBERSECURITY SERVICES

EnerNex recommends a standards based approach to implementing cybersecurity solutions for utilities and has been actively involved in the development of standards and protocols designed to enhance cybersecurity for the electric power industry.

EnerNex's services include the areas of security policy, security architecture, requirements development and gap analysis technology implementation, threat and vulnerability assessments, penetration testing, and regulatory compliance most notably for the NERC CIP standards.



Grid Modernization

As utilities modernize their grids by integrating new technologies, including renewables, and work to meet new policy mandates, they are challenged to improve upon analytical approaches the power industry traditionally trusted to ensure reliable, secure power system performance. Simultaneously, as large energy consumers are adopting renewables, microgrids, and other new technologies, there is a set of new market dynamics and policies that are rapidly accelerating the utility business transformation processes.

EnerNex's custom-built grid modernization programs define and architect individual systems and system-of-systems eco-structures to deliver value based on both practicality and standards. We help bring clarity to complex technologies and operational challenges in the areas of:

- Smart Metering (SM) and Advanced Metering Infrastructure (AMI)
- Utility Communications
- Advanced Distribution Management Systems (ADMS)
- Distributed Energy Resource Management Systems (DERMS)
- Demand Response (DR)
- Enterprise Architecture
- Microgrid Development and integration
- Grid Modernization Roadmaps

Project example

Hawaiian Electric Companies: *Helping with grid modernization strategy (GMS) to help them achieve their 100% renewable energy goal.*

Electric Industry Evolution

Power utilities are transitioning to become more market-oriented businesses. These transitions frequently are based on changes in public policy, the role of customers/consumers, technology innovation, competition from third parties, and a need to properly value electricity provision in a digital society.

Utilities must transform their business models to address these and other factors.

In support of these business transformation challenges, EnerNex offers:

- Strategic Consulting Services
- Utility Investment and Pilot Review
- Position Paper Development
- Business Case Development

Project example

The United Illuminating Company: *Developed microgrid business cases and cost benefit analyses to help quantify the value of these assets for all stakeholders.*

Testing and Certification through our CESI Partner

- CESI acts as an independent conformity assessment body internationally recognized
- Over 1 Million HV, MV and LV components tested in our facilities in Italy and Germany in the last 10 years, 380,000 m^2 (equivalent to 63 football fields)
- More than 300 customer's personnel every day in our facilities
- Over 3,000 m^3 customer objects moved in and out from our laboratories every month

Components and electric systems interact together thanks to our 60+ years testing experience. With our peerless and unique know-how we are the best partner for those businesses that trust the power of experience.

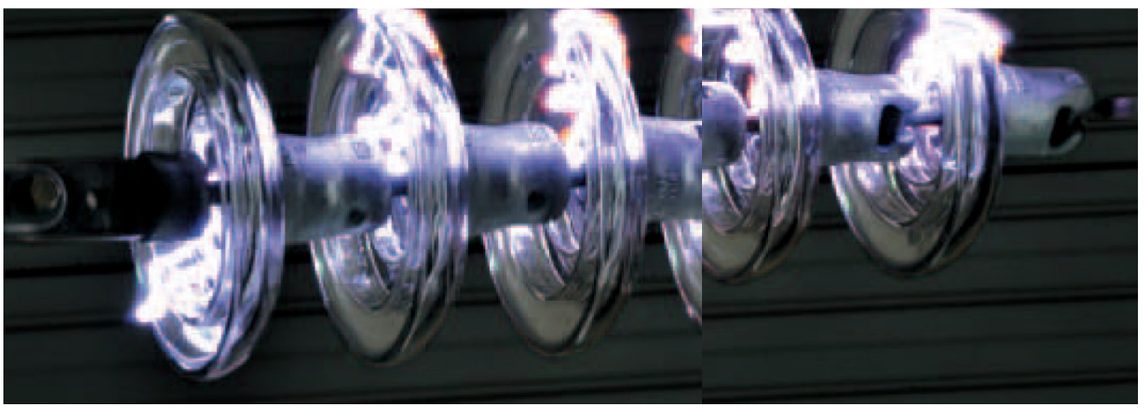
CESI's many testing facilities may assess:

- Electromechanical components from low voltage to ultra high voltage levels in alternating and direct current electronic embedded components for terrestrial or airspace vehicles, smart network devices and meters, etc
- High voltage AC and DC cables and accessories
- New solutions about HVDC systems
- Power electronics systems
- Drives and motors systems up to 45MW

CESI also offers:

- Climatic chambers
- Pollution tests labs
- Anechoic chambers for electro-magnetic test
- Mechanic and vibration platforms for shock test
- Explosion emulation laboratories
- IT communication and Interoperability laboratories for smart components and systems

CESI has also been working for 30 years in the research, development and manufacturing of high efficiency solar cells both for space and terrestrial applications (High-CPV technology) thanks to close cooperation with relevant international space agencies including those of Europe and Italy, and Russia. Today, more than 60 satellites with CESI solar cells fly around the globe with CESI solar cells.



Owner's Engineering Services

EnerNex and CESI act as owner's engineers providing expertise and technical assistance to protect the client's interests under the different phases of a project: components and systems specifications, RFI and RFP requirements, vendor due diligence, documents analysis, design review, in-production and type and routine test inspection, commissioning support and validation of performances.

Support during procurement

- Assist in the procurement process
- Development of tender documents
- Bids evaluation
- Preparation of contract and signing procedures with awarded contractor(s)

Design Review

- Third-party validation of power system studies
- Review and recommend approval of design, plans, technical calculations and drawings

Construction work supervision

- Monitoring and supervision of works, including review and approval of programs for manufacturers and delivery of materials for site construction

Quality Assurance & Factory Tests Witnessing Activities

- In-production inspection assessing & validating quality procedures during manufacturing phase
- Validation of acceptance criteria for factory test specifications and procedures

The activities of Owner's Engineering that EnerNex and CESI can provide include:

- HVAC-HVDC Infrastructures
- Wind, Solar and Conventional Power Plants
- Advanced Distribution Management Systems
- Distributed Energy Resources Management Systems
- Smart Metering and Grid Modernization Projects

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